ratio of carbon atoms to fluorine atoms, the fluorocarbon gas having the lower ratio of carbon atoms to fluorine atoms forming at least one half of the mixed gas. No such step is taught or even remotely suggested by Arleo taken alone or in the total combination as claimed.

Claim 1 further requires the step of etching a connection hole through the electrically insulating layer in a single etching step to the electrically conducting layer using only the mixed gas as the etchant. No such step is taught or even remotely suggested by Arleo taken alone or in the total combination as claimed.

Claims 3 and 4 depend from claim 1 and therefore define patentably over Arleo for at least the reasons presented above with reference to claim 1.

In addition, claim 3 further limits claim 1 by requiring that C_4F_8 be used as the fluorocarbon gas having a lower ratio of carbon atoms to fluorine atoms and at least one selected from the group composed of CHF_3, CH_2F_2, and CF_4 be used as the fluorocarbon gas having a higher ratio of carbon atoms to fluorine atoms. No such step is taught or even remotely suggested by Arleo in the total combination as claimed.

Claim 4 further limits claim 1 by requiring that the insulating layer be plasma-etched with the mixed gas of fluorocarbon gases. No such step is taught or even remotely suggested by Arleo in the total combination as claimed.

Claims 1 to 3 were rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al. (U.S. 5,906,984). The rejection is respectfully traversed.

Claim 1 requires, among other steps, the step of providing a gas etchant comprising a mixed gas of multiple different fluorocarbon gases, each fluorocarbon gas having a different ratio of carbon atoms to fluorine atoms, the fluorocarbon gas having the lower ratio of carbon atoms to fluorine atoms forming at least one half of the mixed gas. No such step is taught or

even remotely suggested by Liu et al. taken alone or in the total combination as claimed. While this step can be extracted from Liu et al. by combining selected portions of the gases recited, it is clear that Liu et al. never appreciated the fact that a combination of gases as claimed in claim 1 could, alone perform the task required and provide the benefits as set forth in the subject specification. This fact is made eminently clear from the fact that Liu et al. requires two separate etching steps at different flow rates to complete the etching step. It follows that, in view of the above described step of claim 1, Liu et al. fails to provide the step of etching a connection hole through the electrically insulating layer in a single etching step to the electrically conducting layer using only the mixed gas as the etchant. No such step is taught or even remotely suggested by Liu et al. taken alone or in the total combination as claimed.

Claim 3 depends from claim 1 and therefore defines patentably over Liu et al for at least the reasons presented above with reference to claim 1.

In addition, claim 3 further limits claim 1 by requiring that C_4F_8 be used as the fluorocarbon gas having a lower ratio of carbon atoms to fluorine atoms and at least one selected from the group composed of CHF_3, CH_2F_2, and CF_4 be used as the fluorocarbon gas having a higher ratio of carbon atoms to fluorine atoms. No such step is taught or even remotely suggested by Liu et al in the total combination as claimed.

Claim 1 was further rejected under 35 U.S.C. 102(a) as being anticipated by Tang et al. (U.S. 6,211,092). The rejection is respectfully traversed since the argument presented above with reference to claim 1 in the rejection under Arleo applies as well to this rejection.

Claims 2 to 7 were rejected under 35 U.S.C. 103(a) as being unpatentable over Tang in view of Miyazaki et al. (U.S. 5, 804,878). The rejection is respectfully traversed.

Claims 3 to 7 depend from claim 1 and therefore define patentably over Tang in view of Miyazaki et al. since Miyazaki et al. fails to overcome the deficiencies in Tang as set forth above.

In addition, claim 3 further limits claim 1 by requiring that C_4F_8 be used as the fluorocarbon gas having a lower ratio of carbon atoms to fluorine atoms and at least one selected from the group composed of CHF_3, CH_2F_2, and CF_4 be used as the fluorocarbon gas having a higher ratio of carbon atoms to fluorine atoms. No such step is taught or even remotely suggested by Tang, Miyazaki et al. or any proper combination of these references in the total combination as claimed.

Claim 4 further limits claim 1 by requiring that the insulating layer be plasma-etched with the mixed gas of fluorocarbon gases. No such step is taught or even remotely suggested by Tang, Miyazaki et al. or any proper combination of these references in the total combination as claimed.

Claim 5 further limits claim 1 by requiring an upper electrically conducting layer connected to the lower electrically conducting layer formed in the connection hole as an electrode or wiring. No such step is taught or even remotely suggested by Tang, Miyazaki et al. or any proper combination of these references in the total combination as claimed.

Claim 6 further limits claim 5 by requiring that the lower electrically conducting layer have a titanium nitride layer on the surface where the connection hole is formed and the electrically insulating layer include a spin-on glass layer. No such step is taught or even remotely suggested by Tang, Miyazaki et al. or any proper combination of these references in the total combination as claimed.

Claim 7 further limits claim 6 by requiring that the lower electrically conducting layer be made of a stacked structure having a titanium nitride layer, a layer of aluminum or an alloy thereof, a titanium layer, and a titanium nitride layer stacked in that order, and the electrically insulating be made of a stacked structure having a silicon oxide layer formed from tetraethylorthosilicate, a spin-on glass layer, and a silicon oxide layer formed from tetraethylorthosilicate stacked in that order. No such step is taught or even remotely suggested by Tang, Miyazaki et al. or any proper combination of these references in the total combination as claimed.

In view of the above remarks, favorable reconsideration and allowance are respectfully requested.

Respectfully submitted,

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1. A semiconductor device manufacturing method comprising the steps of:

providing a semiconductor substrate having a lower electrically conducting layer thereon and an electrically insulating layer disposed over said electrically conducting layer;

providing a gas etchant comprising a mixed gas of multiple different fluorocarbon gases, each fluorocarbon gas having a different ratio of carbon atoms to fluorine atoms, the fluorocarbon gas having the lower ratio of carbon atoms to fluorine atoms forming at least one half of the mixed gas; and

etching a connection hole through said electrically insulating layer in a single etching step to said electrically conducting layer using only said mixed gas as the etchant.

3. A semiconductor device manufacturing method as described in Claim 1 wherein C_4F_8 is used as the fluorocarbon gas having a lower ratio of carbon atoms to fluorine atoms and at least one selected from the group composed of CHF_3, CH_2F_2, and CF_4 is used as the fluorocarbon gas having a higher ratio of carbon atoms to fluorine atoms.

4. A semiconductor device manufacturing method described in Claim 1 wherein the insulating layer is plasma-etched with the mixed gas of fluorocarbon gases.

5. A semiconductor device manufacturing method described in Claim 1 further including an upper electrically conducting layer connected to the lower electrically conducting layer formed in the connection hole as an electrode or wiring.

6. A semiconductor device manufacturing method described in Claim 5 wherein the lower electrically conducting layer has a titanium nitride layer on the surface where the connection hole is formed and the electrically insulating layer includes a spin-on glass layer.

7. A semiconductor device manufacturing method described in Claim 6 wherein the lower electrically conducting layer is made of a stacked structure having a titanium nitride layer, a layer of aluminum or an alloy thereof, a titanium layer, and a titanium nitride layer stacked in that order, and the electrically insulating is made of a stacked structure having a silicon oxide layer formed from tetraethylorthosilicate, a spin-on glass layer, and a silicon oxide layer formed from tetraethylorthosilicate stacked in that order.